



PC Builder

If you're after a more efficient, quieter desktop PC, then help is at hand. Josh Blodwell shows you how you can get your computer purring like a kitten by building a powerful Pentium M-based system



Q How cool is a Pentium M processor in comparison to a Pentium 4?

A The Pentium 4 560 has a core clock speed of 3.4GHz and a thermal design power of 115W. Current Pentium Ms have a thermal design power of just 27W, so the Pentium M produces a quarter of the waste heat of high-end Intel processors. You can use a passive heatsink on a Pentium M processor, but you still need one case fan to remove heat from the case.

Q I've heard Pentium M referred to using processor code names such as Dothan. What do these names mean, and how do they affect me?

A Each time a CPU manufacturer starts a new design project, it gives it a name. The early design of the Pentium M was called Banias. The Banias group of cores are Pentium M chips that have a 400MHz front-side bus and a core clock speed of between 1.23GHz and 1.7GHz. These older chips are available for very little on eBay – about £25 for low-end models. They are cool running and fast enough for a workstation, but don't expect stellar performance.

The latest version, Dothan, is much faster and a lot more expensive. The Dothan cores are Pentium M chips that have a 533MHz front-side bus and range in speed from 1.5GHz to 2.26GHz. These are among the most expensive processors that Intel makes and provide a very powerful and quiet engine for a Media Center PC.



▲ The Pentium M is far more efficient than the Pentium 4 and will run cooler and quieter

A new breed of PC is ditching standard desktop processors. The Hi-Grade DMS XTC 2000, which we reviewed in *What's New, Shopper* October 2005, is an example of a desktop PC based on the Intel Pentium M processor, more often seen in Centrino notebooks. So why would anyone do this? You may think mobile processors are slower than their desktop counterparts, but this is not necessarily the case.

As you'll see, a Pentium M can be surprisingly powerful. Mobile processors also run cooler and require less power, which means a PC built using one is quieter, with fewer fans running at a slower speed. The combination of power and silence is a compelling reason to build a Pentium M-based system, and in this month's *PC Builder* we show you how to do it. You can build a PC for your study that lets you work without the distraction of whining fans, a PC that lets you play games as fast as a high-end Pentium 4 with none of the noise, or the perfect Media Center PC. The Pentium M's speed makes it more than a match for shuttling data from a TV card to a hard disk, while maintaining the serenity of the living room.

SOMETHING OLD, SOMETHING NEW

The Pentium M is a current Intel processor, but it's based on an older design than the Pentium 4 range of chips. It also runs at far slower clock speeds than the Pentium 4. The fastest Pentium M runs at 2.13GHz; the fastest Pentium 4 runs at 3.8GHz.

However, a processor cannot be judged on clock speed alone, as some chips are more efficient than others. That's the reasoning behind AMD's processor-naming scheme. An Athlon 64 3200+ has similar performance to a 3.2GHz processor, but it runs at 2.4GHz.

When designing the Pentium M, Intel strived for this kind of efficiency. To create a capable mobile processor, Intel turned to the Pentium III as the starting point. The Pentium III was a lot more efficient than the Pentium 4, particularly in power consumption, and was arguably a much better design than the Pentium 4. Don't think the Pentium M is an out-of-date processor, though. Intel's engineers reworked the Pentium III design to make it more efficient without drastically increasing its clock speed.

First, extra cache memory was added to the processor. A similar method is used on Intel's Extreme Edition processors to get more power. Next, the processor's pipeline was enhanced. A processor works by executing thousands of instructions in order to achieve a task. A pipeline's job is to streamline the execution of these instructions. Each instruction may involve several steps and require some data from memory.

However, starting work on an instruction after the previous one is complete isn't very efficient.

Instead, a pipeline begins working on instructions in advance, completing steps ahead of time and gathering any data needed.

Usually, the next instruction that the pipeline needs to start working on is easily predicted. However, at certain times the program will reach a branch, a point where two instructions could be executed next, depending on the outcome of the current instruction. The processor can take a guess as to which one is the more likely and then start preparing those instructions for execution. If, however, it picks the wrong one, all that work is wasted, and the pipeline has to be wiped and started again from scratch.

For the Pentium M, Intel's engineers improved the pipeline branch prediction. This cuts unnecessary work, making it a lot more efficient, and helps immensely with certain tasks such as ripping CDs, playing 3D games and editing photos or videos.

All the extra power-saving functions, which help to increase a notebook's battery life, make the Pentium M one of Intel's most advanced processors, and this is why it's expensive. A 2.13GHz Pentium M 770 is £298 including VAT from www.dabs.com; a 3.2GHz Pentium 4 640 costs £146 including VAT.

Though the Pentium M is a very powerful processor, it lags behind the Pentium 4 in certain areas. For example, it's a bit of a slouch when tackling video-encoding work. The processor's short pipeline is mainly to blame for this; it's nowhere near as good as the Pentium 4 at crunching that kind of repetitive data.

The Pentium M is far more efficient in applications that make heavy use of its floating point unit, such as photo editing and playing 3D games. In those applications, the processor makes a massive difference, performing as well as or better than a Pentium 4 processor.

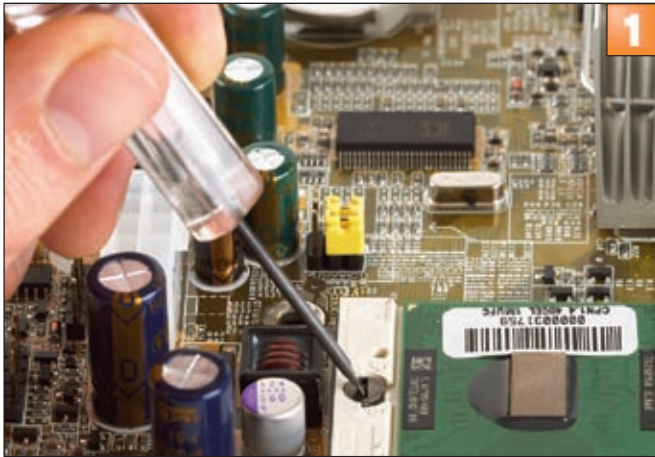
The same efficiency means the Pentium M generates only around 25W of heat, which is ideal for a cramped notebook chassis. A Pentium 4 generates around 100W, which means you need to blast cool air through the case. You might find eight fans in a Pentium 4 system: four on the case, two in the PSU, one on the processor, and one on the Northbridge. As well as running cooler, a Pentium M has a cooler chipset and needs a less powerful PSU. You could easily get down to just one fan in your PSU and one exhaust fan at the back of your case.

CHOOSE YOUR WEAPONS

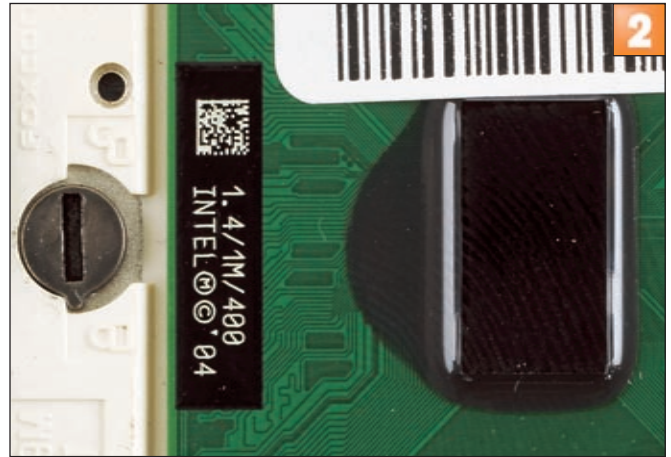
If you're sold on the idea of a quiet processor, you need to choose your components carefully. First, you need to choose your processor. Make sure you buy a Pentium M processor, and be careful that you don't buy a Pentium 4-M or Celeron M by mistake. These are not the same high-performance processors that we're talking about here, and you'll



HOW TO... INSTALL A PENTIUM M



1 The Pentium M socket is clamped and then released using a slot-head screwdriver, as shown above



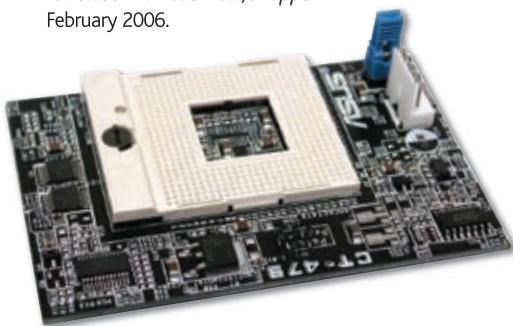
2 Make sure that the slot is turned so the arrow points at the closed padlock to fix your chip in place

be very disappointed if you buy one by accident. See our PC Building FAQ on the left-hand page for full information on which processor to buy.

Pentium M processors come in two versions: a 479-pin version designed to be soldered on to motherboards and a 478-pin version designed to fit in a socket. Though the socket Pentium M has 478 pins and will fit into a Pentium 4 Socket 478 motherboard, it won't work in the Pentium 4 motherboard because the Pentium M is wired differently to the Pentium 4.

There are two ways to use a Pentium M. First, Asus has an adaptor, the CT-479, that lets you fit a Pentium M processor into a Pentium 4 motherboard. It costs £33 including VAT from www.kustompcs.co.uk. It works with only a handful of Asus motherboards, including the Asus P4P800 SE (around £45 including VAT), P4GD1 (around £60 including VAT) and P4GPL-X models (around £54 including VAT). This isn't as simple as it could be, though. Each motherboard requires an update to the latest BIOS version so it can work. In order to do that, you will need a standard Socket 478 Pentium 4 to control the board until the BIOS update is complete.

The easier but more expensive alternative is to buy a dedicated Pentium M motherboard, such as MSI's 915GM Speedster-FA4, which costs £129 including VAT from www.hardwarearea.com. You could also buy a Shuttle XPC SD11G5 Pentium M barebones system, which costs £317 including VAT from www.shooboxcomputers.com and was reviewed in *What's New, Shopper* February 2006.



▲ Asus' adaptor lets you plug a Pentium M processor into a Socket 478 Pentium 4 motherboard



Dedicated Pentium M motherboards may have Mini PCI slots, which you can use to install a wireless adaptor

INSTALLATION TIME

Installing the Pentium M processor into the adaptor or Pentium M motherboard is the same. First, take a flat-head screwdriver and insert it into the slot. Turn the screw anti-clockwise until the notch in the wheel points at the unlocked padlock.

Gently line up the gold triangle on the processor with the white triangular indent on the socket. Press down lightly on the processor to push the processor's pins into the holes until the underside of the chip is flush with the socket. Put the screwdriver into the slot and turn it clockwise until the notch on the wheel points at the locked padlock. See the steps above for help as to how this should look. Your processor is now secured.

COOLING OFF

Even though the Pentium M generates less heat, you'll still need an effective CPU cooler. If you've bought a dedicated motherboard, you are going to need a dedicated Pentium M cooler, such as CoolerMaster's Pentium M cooler (EEP-N41SS-01), which costs £25 including VAT from www.beb.lu.net. Shuttle includes a cooler with its barebones Pentium M case.

If you've chosen the adaptor route, you can use any standard Socket 478 Pentium 4 cooler. If you want silence, Zalman's CNPS6500B-ALCU Flower Cooler costs £26 including VAT from QuietPC (www.quietpc.com). These are not a lot

of use for regular Pentium 4 owners because they can't shift enough heat, but for the cool-running Pentium M they're ideal.

SMALL WONDER

If you've chosen a dedicated Pentium M motherboard, you may be wondering what the extra slot is that looks like it was designed for notebook memory. It is a Mini PCI slot. This connector is a standard designed for mobile computers and other compact PCs. It is intended for wireless network adaptors, and you can buy an IBM 802.11a/b/g adaptor for around £57 including VAT from www.macwarehouse.com.

To install one, set it at roughly a 20° angle and then push the card gently into the slot. Then hinge the card down until it is parallel with the board and the metal retaining clips snap into place.

MEMORY BANDITS

The memory you need for your PC will depend on your motherboard, so check its manual. If you buy a dedicated Pentium M motherboard, there's a chance you'll need DDR2 memory. If you're using an adaptor, you'll need DDR memory.

Relatively slow PC2700 (333MHz) or PC2100 (266MHz) DDR memory will do, but if you haven't already got a stick of this then it's cheaper to buy 512MB of PC3200 (400MHz) memory (which is £38 including VAT from www.crucial.com/uk) and this will be fine at the slower speed.

All the other parts of your PC can use standard components. Any good-quality ATX PSU of 350W output or higher will be able to power the system as long as you don't have too many hard disks. This gives you scope to buy a silent PSU. For instance, Zalman's ATX Ultra-Quiet PSU 400W ZM400B-APS has more than enough power for a Pentium M system, and costs just £69 including VAT from www.quietpc.com. **CS**

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